



# Cooling, Heating, and Power (CHP)

Peer Review Thermally Activated Technologies

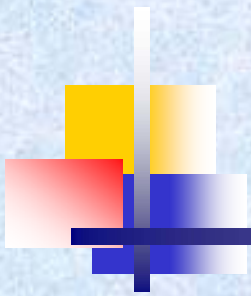
Nashville, TN

May 2, 2002

Presented By:

Leslie E. Farrar (UIC-ERC)



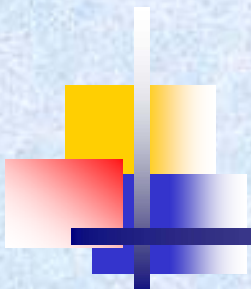


# Overview

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- Project Overview
- Project Elements
- Next Steps
- Lessons Learned

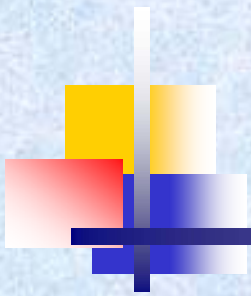




# Midwest Application Center

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- **Technology Transfer** Program
- Concept Born at Roadmap Process
  - Commercial and Institutional CHP
  - Identified by Industry
  - Accepted by DOE
- Pilot Program – April 2001
  - Test Concept – Commercial/Institutional Applications
  - What Works – What Doesn't
  - How Effective
  - Establish Protocol

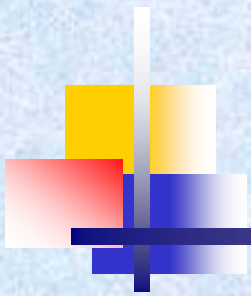


# CHP Target Audience

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- Architects/Engineers
- Building/Facility Owners/Operators
- State/Local Officials
  - Energy Offices
  - Utility Commissions
  - Regulators (General Assembly)

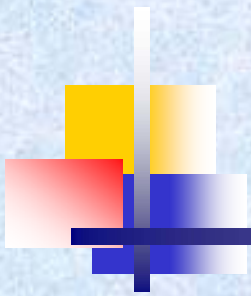




# Needs Identified Early On

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- Educate Target Audience to Benefits
- Influence Changes to Promote CHP
  - Technology
  - Policy
  - Regulatory
- Leverage DOE Activities
  - Distributed Energy
  - Integrated Energy Systems

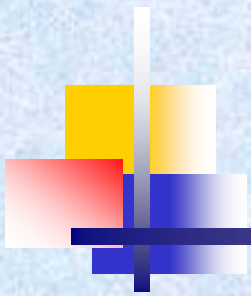


# Working Together in the Midwest

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- Midwest CHP Application Center (MAC)
- Midwest CHP Initiative
- DOE – Chicago Regional Office
- Environmental Protection Agency
  - CHP Partnership
  - Permitting Guidebook

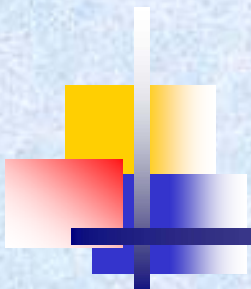




# Working Together in the Midwest

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- CHP Workshop
  - Partnership
    - State of Illinois
    - City of Chicago – Department of Energy
    - Department of Energy – Chicago Regional Office
    - US Environmental Protection Agency
    - Illinois Environmental Protection Agency
  - July 9<sup>th</sup> – Chicago
  - Focus on the Business Case for CHP
  - Targeted to Potential CHP Audience



# Working Together in the Midwest

## **Midwest CHP Application Center**



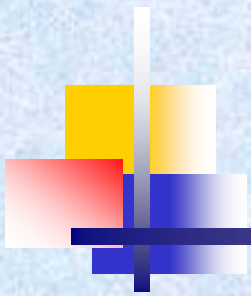
## **Midwest CHP Initiative**

- DOE Funded Project
- UIC/ERC & GTI

- Coalition (Voluntary)
- Founding Members
  - GTI
  - UIC/ERC
  - Delta Institute
  - ELPC
  - NiSource

**Promote the Use of CHP in the Midwest**



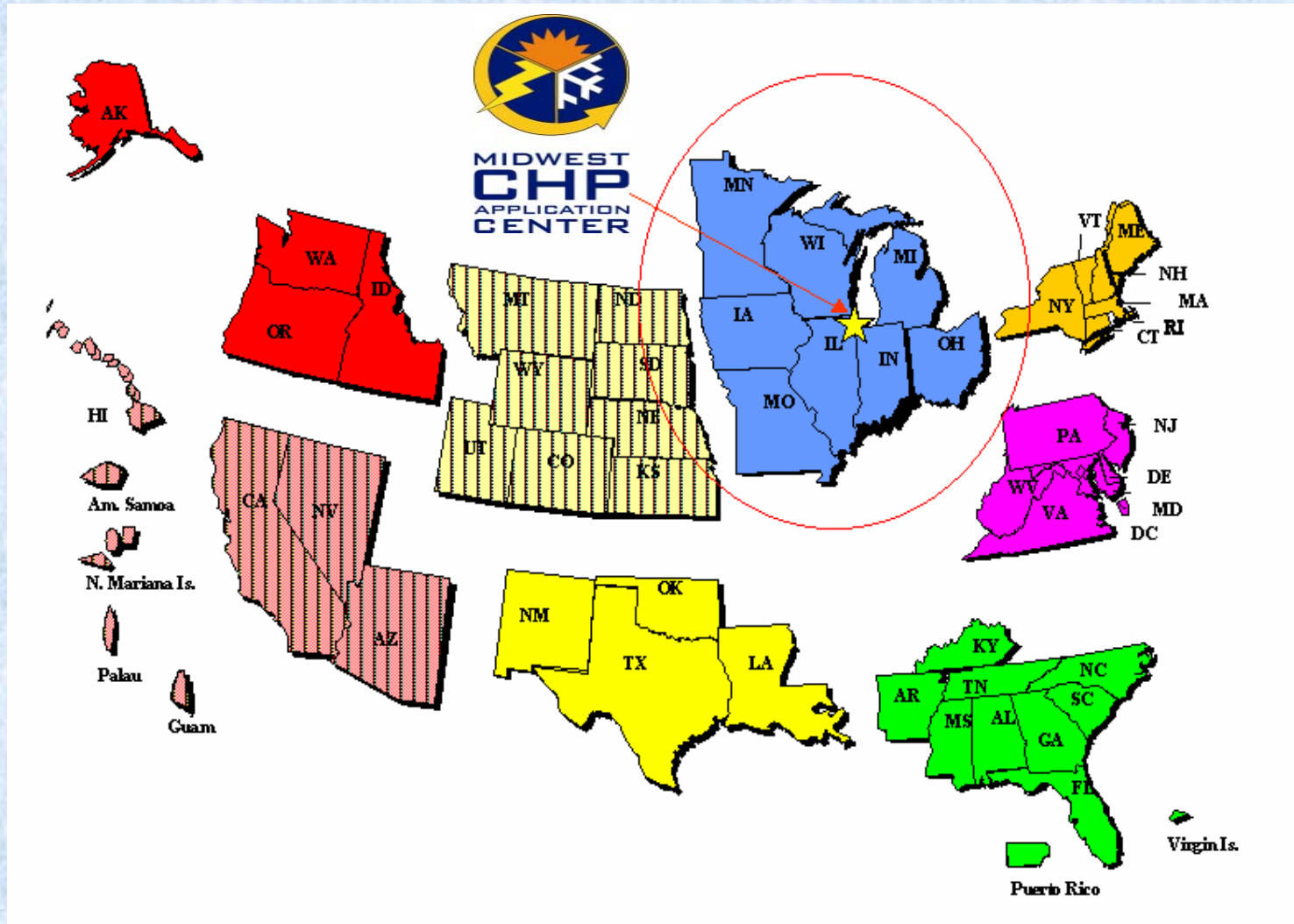


# Midwest CHP Initiative

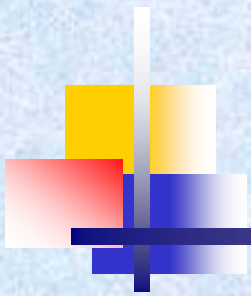
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- Voluntary Coalition of Interested Organizations
  - GTI
  - UIC/ERC
  - Delta Institute
  - ELPC
  - US DOE Chicago Regional Office
  - NiSource
  - Peoples Energy
  - Northeast/Midwest Institute
  - Illinois DCCA
  - Indiana Department of Commerce
  - Wisconsin Division of Energy
  - Michigan Public Service Commission
  - Minnesota Department of Commerce
  - US EPA
  - US EPA Region V

# Midwest Regional Application Center







# Midwest Application Center

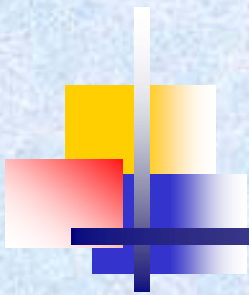
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## ■ **Vision:**

“By the year 2020, CHP for Buildings Will Be the Preferred Method of Energy Utilization In Commercial and Institutional Buildings.” --- BCHP Initiative Roadmap

## ■ **Market Scenario:**

The Economic, Reliability, and Emission Drivers are Emerging Whereby CHP for Buildings and Industry Can Be Successful in the Midwest.



# Midwest Application Center

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- **Mission:**

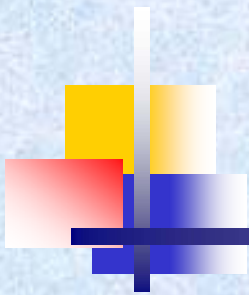
Develop Technology Application Knowledge and the Educational Infrastructure Necessary to:

- Reduce Perceived Risks
- Foster CHP as a Viable Option
  - Technical and Financial
  - Energy and Environmental

- **Focus:**

- Technology Transfer
- Education
- Information
- Project Assistance





# Midwest Application Center

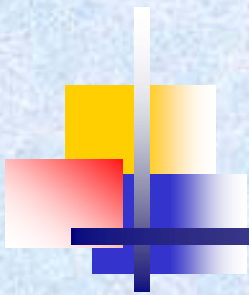
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- **Objective:**

- Positively Affect the DOE CHP Challenge in Midwest
  - 10 GW CHP Total
  - 2 GW CHP for Buildings

- **Goals:**

- Expand Technology Breadth
- Increase the Number and Type of Sites in Target Markets
- Increase Installed Capacity
- Formulate State and Local Partnerships



# Midwest Application Center

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- **Partnership:**

- University of Illinois at Chicago  
Energy Resources Center --- UIC/ERC

*and*

- Gas Technology Institute --- GTI

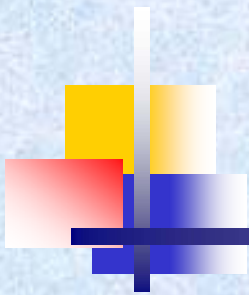
- **Sponsorship:**

- DOE Office of Power Technologies  
Office of Distributed Energy Resources

- **Technical/Program Guidance:**

- Oak Ridge National Laboratory --- ORNL





# Project Elements

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- Technology Transfer – Getting the Word Out
- Website/Information Repository
- State Baseline Characterizations
- Project Support
- Case Studies
- Application Guidebook



# Getting the Word Out

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- Association Presentations
  - Midwest Energy Efficiency Alliance (MEEA) (Chicago)
  - Midwest Cogeneration Association (MCA) (Chicago)
  - National Association of Environmental Managers – Chicago Chapter
  - Chicagoland Arts and Sciences Energy Consortium (CLASEC)
  - National Organization of State Energy Offices (NASEO)(WDC)
  - American Gas Cooling Center (AGCC) (IL)
  - Association of State Energy Research and Technology Transfer Institutes (ASERTTI)
  - Illinois Capital Development Board (Springfield)

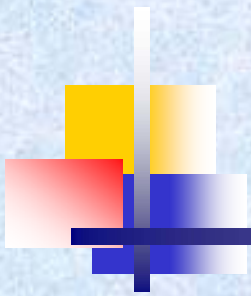




# Getting the Word Out

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- Conferences and Workshops Presentations
  - DOE Peer Review (WDC)
  - Minnegasco Seminar (MN)
  - USCHP Road Mapping Workshop (MD)
  - International Energy Conference (OH)
  - Midwest Plant Engineering and Maintenance Show (MN)
  - Illinois Governors Energy Policy Cabinet Workshop (IL)
  - Microgeneration to Power Parks Conference (MI)
  - State CHP Workshop (IN)

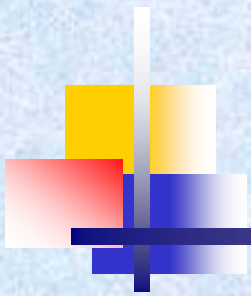


# Getting the Word Out

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- Tours of UIC East and West Campus CHP Facilities
  - DOE
  - AGCC
  - ASERTTI
  - MCA
  - Peoples Gas of Florida
  - Primera Engineering

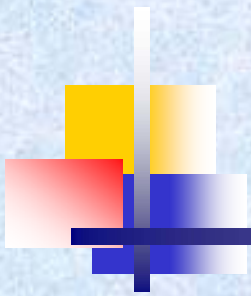




# Getting the Word Out

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- Co-Hosted “Energy Days” with the Delta Group (Chicago)
  - Six Specific Potential Sites
  - Several Chicago Area Developers, Architects, and Engineering Firms
- Hosted Association of State Energy Research and Technology Transfer Institutes (ASERTTI) Meeting
  - One-Day Seminar on CHP

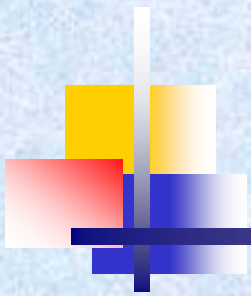


# Getting the Word Out

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- Interconnection Workshop
  - Co-Hosted with GTI
  - One-Day Workshop
  - Midwest Region State Energy Offices
    - Directed to Individuals Responsible for the Development of Interconnection Requirements
  - Seven Midwest States Participated
  - Feedback Very Positive

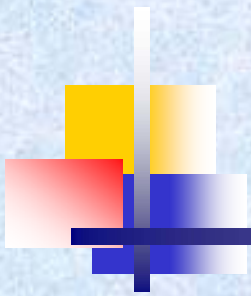




# Getting the Word Out

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- CHP Assessment Training
  - 3-Days
  - Add to Base Assessment Resources
  - Increase Assessment Awareness
  - Attendees
    - MAC Personnel
    - ERC Energy Auditors
    - Chicago Department of Environment
    - GTI
    - IDCCA

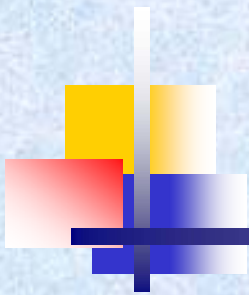


# Getting the Word Out

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- One-on-One Meetings with Target Audience
  - Illinois
  - Indiana
  - Minnesota
  - Ohio



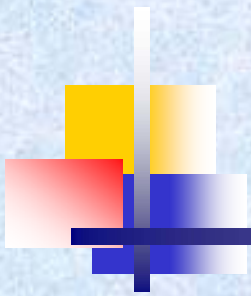


# Website

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- Beta Version Issued February 2002
  - Included Website Based Site/Contact Database
- Launched Final Version April 2002

[www.CHPCenterMW.org](http://www.CHPCenterMW.org)



# Website - Features

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- Audience Focused
- Regional and 8 State Specific Information
- Integrated with National CHP Site
  - Interactive Database of Site Installations and Contacts
  - Technology Animations
  - Interactive Virtual Tours of Test Site



# Website – Home Page



## Cooling, Heating and Power for Buildings

Reduce energy cost • Improve power reliability • Increase energy efficiency • Improve environmental quality

- News & Events
- Technical Professionals
- Building Owners
- Policy Makers/Planners
- Financial Institutions
- General Public
- Region/State
- MAC Outreach
- MAC Partners
- Library
- Links

Search this site:

Search

[Sitemap](#) • [Home](#)



### A New Perspective on Energy

Integrated systems for cooling heating and power (CHP) for buildings, incorporate multiple technologies for providing energy services to a single building or to a campus of buildings. Electricity to such buildings is provided by on-site or near-site power generators using one or more of the many options: Internal combustion (IC) engines, combustion turbines, mini- or micro-turbines, and fuel cells. In CHP systems, waste heat from power generation equipment is recovered for operating equipment for cooling, heating, or controlling humidity in buildings, by using absorption chillers, desiccant dehumidifiers, or heat recovery equipment for producing steam or hot water. These integrated systems are known by a variety of acronyms: CHP, CHPB (Cooling, Heating and Power for Buildings), CCHP (Combined Cooling Heating and Power), BCHP (Buildings Cooling, Heating and Power), and IES (Integrated Energy Systems).

CHP systems provide many benefits, including:

- Reduced energy costs
- Improved power reliability
- Increased energy efficiency
- Improved environmental quality

 Click map to check status in your state

The Midwest CHP Application Center was established in March 2001 for the U.S. Department of Energy (DOE) at the University of Illinois at Chicago (UIC) Energy Resources Center (ERC). The Center is a partnership between UIC/ERC and the Gas Technology Institute (GTI). Its mission is to provide application assistance, technology information, and educational support in the eight Midwest states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

### News & Events

The Midwest CHP Application Center presented an update at the First Annual CEC Conference and Peer Review organized by the U.S. Department of Energy's Distributed Energy Resources Group (DOE-DER).



The presentation by Ted Branson was well received, with many positive comments regarding how the activities of the MAC and the MW CHP Initiatives are "model CHP activities, leading the country in regional CHP efforts."

[More](#)

The objective of this site is to provide you with information on CHP for buildings to facilitate your decisions relating to these systems. Information on the site has been organized to address anticipated needs of various user groups. Click on a link of your choice to learn about some of the basics, benefits, success stories and much more. The site incorporates an interactive database of CHP installations, along with animations, [multimedia videos](#) and a [virtual tour of a CHP System facility](#).


As you move through the site, your current location will be identified by "bread crumbs" along the top of all pages. Available sub-topics will appear in the list of links, on the left of the page, below the link for the major category currently open. The footer for each page also contains links to all the major sections of this Website and the major organizations providing support for it.

### Vision, Mission and Focus of the Midwest CHP Application Center

#### Vision

Vision of the U.S. Department of Energy and its partners in CHP for buildings is that by the year 2020, CHP for buildings will be the preferred method of energy utilization in

# Website – Site Search




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OAK RIDGE  
NATIONAL LABORATORY



### Library - Installation Database

#### Site Search

Please Note: If no search criteria is specified all sites will be returned.

State:

City:

Building Type:

Generation Type:

Thermal Recovery System Type:

[Top](#)

[News & Events](#) • [Technical Professionals](#) • [Building Owners](#)  
[Policy Makers/Planners](#) • [Financial Institutions](#) • [General Public](#)  
[Region/State](#) • [MAC Outreach](#) • [MAC Partners](#) • [Library](#) • [Links](#)  
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# Website – Installation Database



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OAK RIDGE  
NATIONAL LABORATORY




### Library - Installation Database

#### Site Search Results

Goose Island Brewery	1800 W. Fulton St. Chicago, IL, 60612	<input type="button" value="Go To"/>
Krack - Hussman	401 S. Rohlfing Rd. Addison, IL, 60101	<input type="button" value="Go To"/>
McCormick Place	Chicago, IL,	<input type="button" value="Go To"/>
FCS Paper Company	Alsip, IL,	<input type="button" value="Go To"/>
Rice University	Houston, TX,	<input type="button" value="Go To"/>
Magic Valley Foods, Inc.	Rupert, ID,	<input type="button" value="Go To"/>
GE Capital Auto Financial Services	Barrington, IL,	<input type="button" value="Go To"/>
MCWorldcom	Riverdale, IL,	<input type="button" value="Go To"/>
Power Net	, ZZ,	<input type="button" value="Go To"/>
Transamerica	Schaumburg, IL,	<input type="button" value="Go To"/>
Van Buren Data Center Optimal Path	, ZZ,	<input type="button" value="Go To"/>
Alma Nelson Health Care Facility	, ZZ,	<input type="button" value="Go To"/>
Alma Nelson Health Care Facility	, ZZ,	<input type="button" value="Go To"/>
Christ Hospital and Medical Center	Oak Lawn, IL,	<input type="button" value="Go To"/>
Condello Memorial Hospital	, ZZ,	<input type="button" value="Go To"/>
Gottlieb Memorial Hospital	, ZZ,	<input type="button" value="Go To"/>
Hinsdale Hospital	Hinsdale, IL,	<input type="button" value="Go To"/>
Lake Forest Hospital	Lake Forest, IL,	<input type="button" value="Go To"/>
Little Company of Mary Hospital	, ZZ,	<input type="button" value="Go To"/>
Wellesley College	, NY,	<input type="button" value="Go To"/>
Northwest Community Hospital	Evanston, IL,	<input type="button" value="Go To"/>
Park Strathmoor Health Care Facility	, ZZ,	<input type="button" value="Go To"/>

# Website – Contact Search

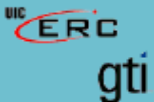


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OUR RIDGE NATIONAL LABORATORY



### Library - Contact Database

**MW CHP Application Center Contact On-Line Database**  
No formal evaluation of the companies or organizations identified in this database has been performed by the Midwest CHP Application Center (MAC), therefore there is no endorsement, implied or otherwise, made by the MAC by the identification of a company or organization in this database list. As is normal prior to entering into any contract or conducting significant business with any company or organization, it is recommended that a prudent investigation of that company or organization be made.

#### Contact Search

Please Note: If no search criteria is specified all contacts will be returned.

State:

Last Name:

Company Name:

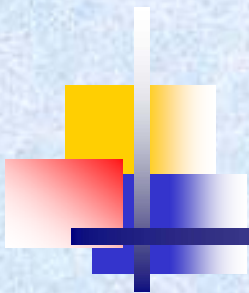
Contact Type:

Firm Type:

[Top](#)

[News & Events](#) • [Technical Professionals](#) • [Building Owners](#)  
[Policy Makers/Planners](#) • [Financial Institutions](#) • [General Public](#)  
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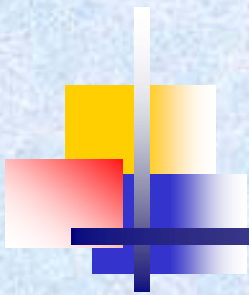




# Baseline Characterizations

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- By State
  - Illinois and Michigan Completed
- Identify and Assess
  - Current Installations
  - Market Potential
  - Current Energy Policy and Pricing
    - Electricity
    - Natural Gas
  - CHP Partners
  - Status of Deregulation
  - Barriers/Opportunities
- Help Focus Application Center Activities



# Site Identification

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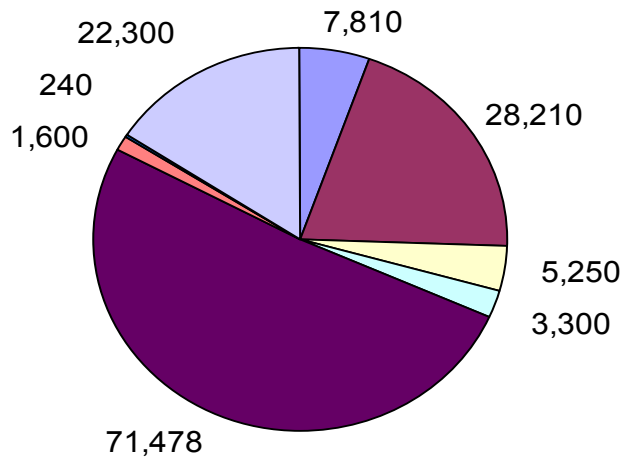
## Installed Kilowatts

State	Sites	Kilowatts
Illinois	20	48,700+
Michigan	14	6,200+



# IL Installed DG

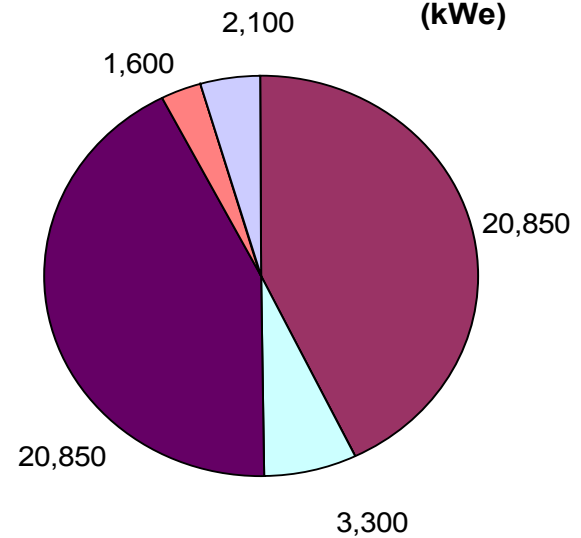
**Generation Installed  
(kWe)**

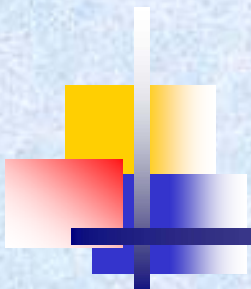


- Data Centers
- Hospitals
- Museums/Zoos
- Conference Centers
- Schools/Universities/Research Centers
- Stores
- Warehouses/Restaurants
- Water Treatment/Resource Recovery Facilities

## Illinois

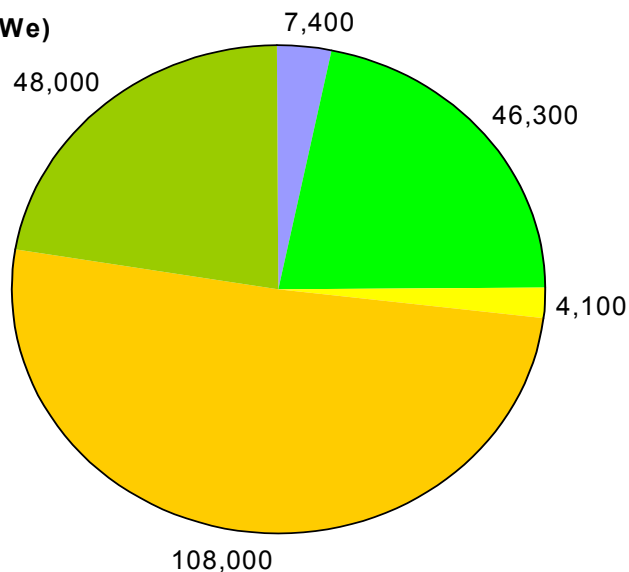
**Generation Installed  
w/ Heat Recovery  
(kWe)**





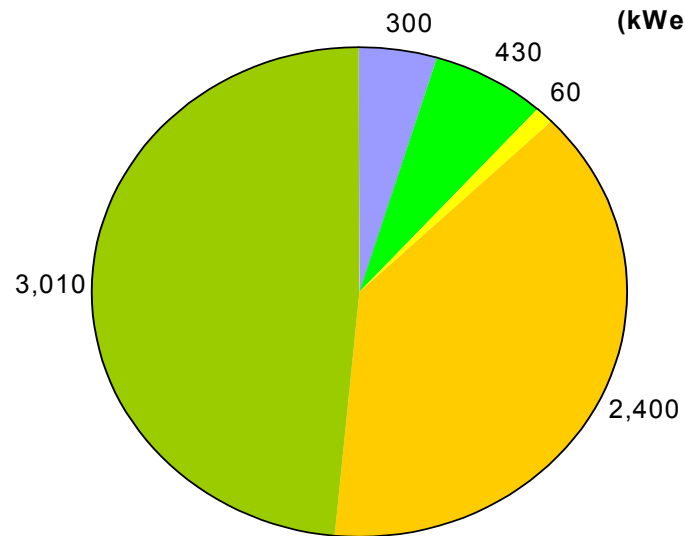
# MI Installed DG

**Installed Generation  
(kWe)**



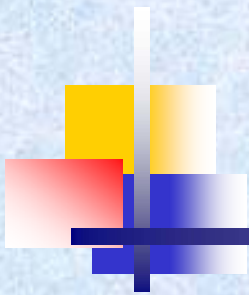
Michigan

**Installed Generation  
w/ Heat Recovery  
(kWe)**



- Hospitals
- Municipal Water/Resource Recovery
- Hotels/Offices
- Schools/Universities
- Landfill Gas/Others





# CHP Market Potential

## Estimated Theoretical Potential

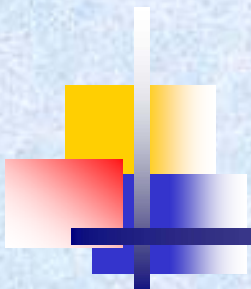
State	Megawatts	National CHP Goal
Illinois	2,410 to 7,480	24 - 75%
Michigan	2,410 to 7,480	24 - 75%

*Source: "The Market and Technical Potential for Combined Heat and Power in the Commercial/Institutional Sector"*

-ONSITE Energy Corporation

-2000





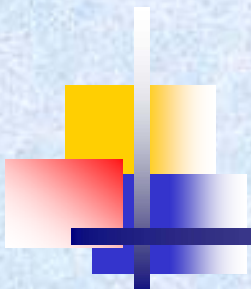
# Average Natural Gas Prices

	Illinois	Michigan
Commercial - Delivered	\$4.84	\$5.81
Industrial - Delivered	\$3.70	\$5.02
Wholesale - City Gate	\$2.46	\$3.68

*per 1000 cu. ft.*

*EIA State Average Prices October 2001*

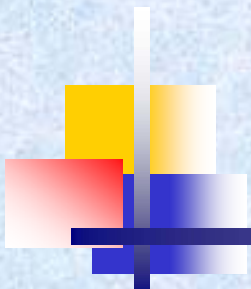




# Average Electric Price

	Illinois	Michigan
¢/kWh	6.98¢	7.14¢
\$/MBTU	\$20.45	\$20.92
Rank <i>(Most Expensive in Nation)</i>	17 <sup>th</sup>	14 <sup>th</sup>

*Average over all customer classes in 1999  
Includes demand charges*

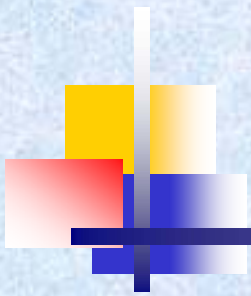


# Baseline Characterizations Conclusions

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- Most Effective Deployment
  - State and Local Levels
- Reaffirmed Barriers
  - Lack of Interconnection Standards and Fees
  - Standby Charges and Rates
  - Operating Costs
  - Capital Costs and Payback
- Identified Some Favorable Characteristics
  - Open Access
  - Favorable Alliances
  - Reasonable Market Potential

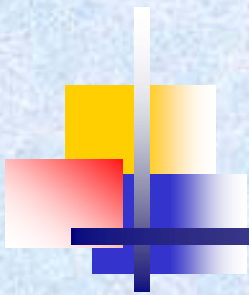




# Baseline Characterizations Recommendations

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- Work with Industry Partners to Increase Interest In Market Penetration
- Work with Governmental Entities and Associations to Influence the Removal of Regulatory Barriers
- Build Strong Alliances with CHP Partners

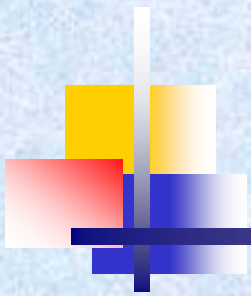


# Project Support

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- Initial Screening Assessments
- Technology Education
- Viable Site Assessment Visits
- Case Studies
- Assist in Project Justification
- Partnership Assistance
- Feasibility Assessments
- SWAT Team Assistance



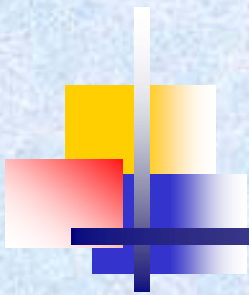


# Project Support

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Apply “Expert” Assistance (SWAT Teams) to High Impact Projects to ...

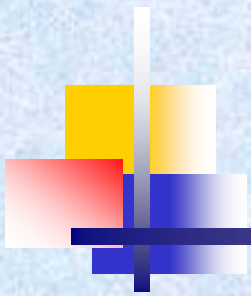
- “Remove Perceived Risk”
- “Identify Technical Solutions”



# Project Support Accomplishments

- Technical Assistance Program Developed
  - Project Support by Stages
    - Standard Outreach - *Information*
    - Investigation – *Viability Assessment*
    - Design Bid – *Detailed Assessment and SWAT*
    - Post Commission – *Case Study*
  - Screening Criteria for Each Stage
    - Target Audience
    - Electric/Thermal Compatibility
    - Financial Viability
    - Financial Availability
- CHP Assessment Training





# Current Project Involvement

- Commercial
  - Retail
  - Multifamily
  - Health Club
  - Museums
- Institutional
  - High Schools
  - Colleges
  - Universities
- Light Industry
  - Plating and Film Coatings
  - Metal Gear
  - Meat Packing
  - Paper
  - Brewery
  - Refrigeration Coil
  - Chocolate

~ 100 MW<sub>e</sub>



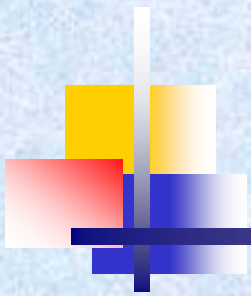
# Case Studies

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- Accomplishments

- Analysis and Framework Protocol Established
- Case Studies/Fact Sheets Included on Website
- Website Database Includes Fields for Information from Case Studies
- Case Study Progress
  - University of Illinois East Campus (Chicago, IL) - Completed
  - Beloit Memorial Hospital (Beloit, WI) - Draft
  - Dakota Station (Burnsville, MN) - In Progress

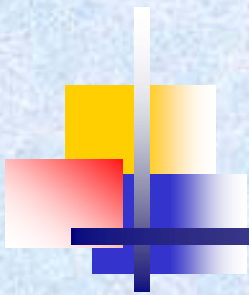




# Application Center Guidebook

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- Describes Regional Application Centers Implementation and Operation
  - Protocol and Processes
  - Organization and Structure
  - Technical Assistance/SWAT Program
- Tool Kits
- Lessons Learned

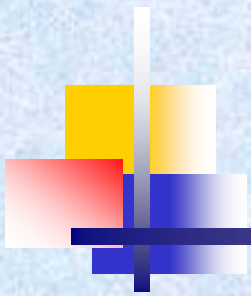


# Application Center Guidebook

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- To Be Used for
  - DOE Establishment of Other Regional Application Centers
  - Information for Others Interested in Establishing CHP Centers
  - Information for State and Local Entities Interested in Promoting CHP



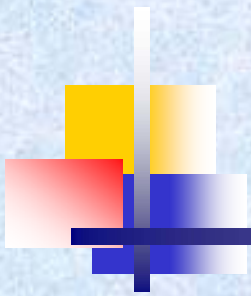


# Next Steps

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Building Strong Alliances and Leverage Activities with CHP Partners and Governmental Entities to ...

- Provide Technical and Financial Assessments
- Provide Technical Project Assistance
- Educate Decision Makers on the Benefits and Feasibility of CHP
- Influence the Removal of Regulatory Barriers
- Establish New Installations
- Continue Technology Transfer Activities

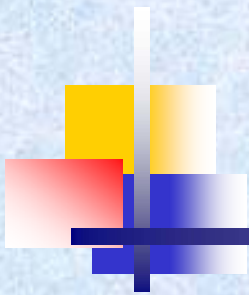


# Next Steps

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- Further Implementation of the Technical Assistance Program
- Finalize Application Center Guidebook
  - Including a Statement of Work
- Four Additional Case Studies
- Two Journal Articles
- Update/Maintain Website
- Chair the Midwest CHP Initiative

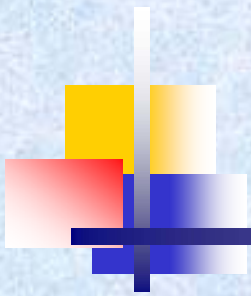




# Lessons Learned

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- Large Task -- But Doable
  - 75 Years of Thinking to Change
    - Old
      - Electric and Heating/Cooling Separate
      - Improvements Based Equipment Efficiency
    - New
      - Integrated Energy Systems
      - Focus on System Efficiency
  - Deregulation Creates Financial Uncertainties
  - Energy Security and Quality Issues

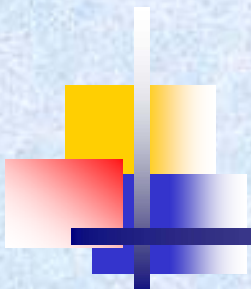


# Lessons Learned

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- Local Initiatives
  - Provide Concepts and Ideas
  - Locally Focused - Grassroots
  - Voluntary
- Application Centers
  - Provide Structure and Resources
  - Locally Focused
  - Funded
- IES Industry Partnership Needed
  - Coalition to Speak With One Voice
  - Strategic Planning
  - Industry Sponsorship





# For Further Information

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## **Midwest CHP Application Center**

[www.CHPCenterMW.org](http://www.CHPCenterMW.org)

Leslie Farrar (UIC/ERC): (312) 413-5448

## **Midwest CHP Initiative**

[www.nemw.org/uschpa/regional.htm](http://www.nemw.org/uschpa/regional.htm)

Ted Bronson (GTI): (847) 768-0637

## **DOE – Chicago Regional Office**

[www.eren.doe.gov/cro/](http://www.eren.doe.gov/cro/)

Gary Nowakowski (DOE Chicago Office): (312) 886-8561